R & D facts

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Super Computing Science Consortium (SC)^2

Good partnerships pool resources to achieve common or synergistic goals and objectives. An excellent example is the Supercomputing Science Consortium (SC)^2, a partnership formed in 1999.

This partnership is underpinned by a high-speed fiber optic network that provides scientists in western Pennsylvania and West Virginia access to state-of-the-art tools for energy and environmental research. The network, known as INNOVA-Link, supports data, video, and voice communications, and links Carnegie Mellon University (CMU), the National Energy Technology Laboratory (NETL), Pennsylvania State University (PSU), the University of Pittsburgh, and West Virginia University (WVU) with the high-speed computing resources at the Pittsburgh Supercomputing Center (PSC). Through the interaction of the West Virginia Governor's Office of Technology, 36 independent colleges and universities in West Virginia have access to these resources.

Background

- NETL researchers are developing complex simulations of multiphase flows fuels gasification and combustion, fuel cell operation, fluid dynamic systems, and geological processes that require computers using massively parallel processing (supercomputers) and high speed communications to interactively transfer data and visualize the simulation results.
- The West Virginia university system, in particular WVU and the participating WV EPSCoR colleges are experiencing similar needs. As a member of the WV Science and Technology Advisory Council (the WV GOT), NETL's Director was aware that all WV researchers were handicapped by lack of adequate high-speed data transmission capability between the state and the Second Generation Internet (Internet 2).
- PSC, affiliated with CMU, has high speed Cray, Compaq, and Intel based multiprocessor computers that could be underutilized. PSC is a hub for Internet 2, and also is a node on DOE's ESNet system which links the National Laboratories and numerous universities.
- A solution to long range computational needs was found through the creation of the (SC)^2. Under this agreement all parties share knowledge and resources to expand the access to high performance computing, communications, and visualization in accomplishing their respective missions.

Super Computing Science Consortium $(SC)^2$

Actions

- In FY 2000, NETL provided $100,000 to conduct preliminary tests of NETL simulations using PSC and WVU resources. The tests ran advanced energy simulations on the PSC Cray. This showed the feasibility and usefulness of the PSC supercomputers for these applications.
- In FY 2001, NETL used $4 million available from the FE budget for the following purposes:
  - Establish a high-bandwidth fiber optic line between PSC, the two NETL laboratory sites at Morgantown and Pittsburgh, and WVU.
  - Provide supercomputer time on the PSC systems to NETL, WVU, Pitt and other FE researchers to address issues in combustion and conversion energy processes and other energy and environment related research issues, and to address DOE's education mission by encouraging use by students and faculty.
  - Provide appropriate expert consulting and support to NETL and WVU system researchers in utilizing the computational and high speed communications systems.
- $(SC)^2$ has worked cooperatively with Penn State University, the Greene County (PA) I Development Authority, and Waynesburg College (PA) on regional communications and computation issues

Results to Date

- A solution to the communications problem was found by utilizing NETL's relationship with PSC to bring a 155 Mb/sec fiber optic cable line between PSC, WVU, and both campuses of NETL, including appropriate links to ESNet and other scientific networks for collaboration among researchers, allowing NETL and WVU to connect in a cost sharing arrangement. The result is state of the art access to NETL and WV researchers at costs comparable to current rates for a lower level of service.
- Because of the proximity of the high-bandwidth communications line to a technology park in Greene County, PA, interest was expressed by officials in that county in connecting to the PSC, the Pittsburgh Gigapop, and other members of $(SC)^2$. $(SC)^2$ has worked with the county development authority to achieve their goal.
- Working groups were formed on cluster computing, data communications, high-performance computing, K-12 educational outreach, and visualization. Several workshops and training courses on topics related to supercomputing were sponsored by the Consortium, including workshops on Beowulf Clusters at several locations in WV.
- A process was developed to arrange "starter grants" for researchers at NETL, WVU, and other locations to gain familiarity with the capabilities of the supercomputing facilities at PSC. The process is web-based and accessible, and has resulted in use by at least sixteen researchers to date. NETL contractors involved in modeling and simulation are also eligible to use the system, and several have begun exploratory use. In a parallel program, NETL developed a collaborative effort in computational chemistry with regional universities, and is using computational resources on the system.

Future Plans

- In FY 2002, approximately $2 million are available to continue the partnership activities.
- Work will continue in high-performance computing, cluster computing, and visualization methods development, increasing the collaboration between NETL scientists, WVU faculty and students, and other regional universities and institutions.
- Efforts to expand use of the system to NETL contractors will encourage collaboration among scientists developing "device models" of energy processes as well as dynamics simulations of complex energy systems.
- Expansion of the system to link into areas such as Greene County(PA) Industrial Park and regional 4 year colleges will continue.